S102PRP
SCIENCE—PREPARATORY ACCESS MATERIAL
STUDY GUIDE AND ASSIGNMENTS

The Open University

# INTO SCIENCE

## STUDY GUIDE AND ASSIGNMENTS

# STUDY GUIDE AND ASSIGNMENTS

# THE INTO SCIENCE COURSE TEAM:

CHAIRS
Judith Metcalfe
Alison Halstead

GENERAL EDITOR
Judith Metcalfe

AUTHORS
Bob Cordell (Staff Tutor, East Midlands Region)
Dee Edwards (Department of Earth Sciences)
Alison Halstead (Staff Tutor, West Midlands Region)
Judith Metcalfe (Staff Tutor, West Midlands Region)
Dave Williams (Department of Earth Sciences)

EDITOR
Clive Fetter

CONSULTANTS
Mark Atlay (Centre for Science Education)
Stuart Bennett (Department of Chemistry)
Jane Nelson (Staff Tutor, Northern Ireland)
John Walters (Staff Tutor, Wales)
Ruth Williams (Staff Tutor, South West)

OTHERS WHO HAVE HELPED WITH PRODUCTION
Debbie Crouch (Designer)
Perry Morley (Senior Editor)
John Taylor (Illustrator)

FRANCHISE CO-ORDINATOR
Alison Halstead

OTHERS WHO CONTRIBUTED TO EARLIER EDITIONS
Trevor Brown (Part-time Tutor, West Midlands)
Sharon Buckley (Bournville College of Further Education, Birmingham)
Anne Kavanagh (Wulfrun College, Wolverhampton)
Martin Lissenburg (Part-time Tutor, West Midlands)
Claire Nelson (Illustrations consultant)
Gwen Parsons (North Warwickshire College of Technology and Art, Nuneaton)
Nick Studdert-Kennedy (Illustrations consultant)
Peter Turner (Illustrations consultant)
Richard Williams (Part-time Tutor, West Midlands)

The Open University, Walton Hall, Milton Keynes MK7 6AA.

The course was developed in the West Midlands Region and first published as a pilot project in 1991. Revised 1992, 1993, 1994.



Edited, designed and typeset by the Open University.

Printed in the United Kingdom by Page Bros, Norwich.

SUP 28904 6

This text forms part of an Open University Foundation Course. If you would like a copy of *Studying with the Open University*, please write to the Central Enquiry Office, PO Box 200, The Open University, Walton Hall, Milton Keynes, MK7 6YZ. This text is also part of an Access Pack. For further information on Open University access study packs, write to Central Enquiry Service, PO Box 280, The Open University, Walton Hall, Milton Keynes MK7 6YZ, requesting the Community Education brochure.

2.1

# 1 INTRODUCTION

Welcome to *Into Science*. We are sure that you have made a good decision in choosing science as your Foundation Course and that you will find plenty to interest and excite you in S102 no matter whether you are a novice or an expert in science.

In introducing the different topics, S102 takes care to start from a basic level. Nevertheless, as there is a new Unit each week, some students can feel rushed. This is why *Into Science* is important. *Into Science* gives you the opportunity to develop and practise essential skills within a broad scientific context, in other words to prepare yourself for the *Science Foundation Course*. For example, you may well have learnt some maths a long time ago and have forgotten most of it. To learn, or relearn, the maths at the same time as the science in S102 would be heavy going. *Into Science* provides the solution; in the autumn before you start S102 you can prepare yourself in an interesting and appropriate way. As well as mathematical skills *Into Science* introduces you to other skills such as study, scientific and writing skills.

By studying *Into Science*, you can have more time to practise these skills, without feeling pressurized to keep up with the Foundation Course. Once you start S102 you will not be distracted from the scientific ideas in it by the need to learn these skills. Your progress will be much smoother and quicker as a result.

We hope that you enjoy *Into Science* and decide that the time you spend studying it is time well spent.

## 2 THE COMPONENTS OF *INTO SCIENCE*

The components of *Into Science* and how they relate to each other are summarized in Table 1. There are 12 Modules and a Workbook to be studied in parallel with the Modules. The Workbook consists of exercises for practising maths and science, and provides additional explanations and hints. The content of each Module and associated study times are explained in more detail in Module 1, and we won't repeat them here.

TABLE 1

| Study Week | Module | Work Book Section | T V | Assignment Practice |
|---|---|---|---|---|
| 1 | 1 | 1 | TV1 anytime in the early part of the course | |
| 2 | 2 | 2 | | |
| 3 | 3 | 3 | | |
| 4 | 4 | 4 | | |
| 5/6 | 5/6 | 5/6 | | Post CMA 51 after completing Modules 5/6 |
| 7 | 7 | 7 | | Post TMA IS 01 after receiving information about your tutor counsellor |
| 8 | 8 | 8 | TV2 after studying Module 8 | |
| 9 | 9 | 9 | | |
| 10 | 10 | 10 | TV3 after studying Module 10 | Post CMA 52 after completing Module 10 |
| 11 | 11 | none | | |
| 12 | 12 | none | | Post TMA IS 02 only if advised to do so. |

You will see that there are no dates on the Table because different students receive *Into Science* at different times. We suggest that you make your own timetable of study by putting your start date—a Saturday—on Table 1. For example, if you received this mailing by the first Wednesday in September then your start date for Module 1 is the next Saturday in September. Try to complete one Module per week, but see Table 1, Module 1, for more details.

If you are a continuing student (one who has already done an OU course) you will probably receive *Into Science* in November. Clearly you will

need to speed up your study to more than one Module per week to make sure that you finish *Into Science* before S102 begins. Since you already have studied an Open University course, studying will not be new to you even though science may be. You should also note, if you are a continuing student, that you should only complete the CMAs and *not* the TMAs. Clearly you already have experience of completing TMAs.

The next Sections help you plan your preparatory work and describe the remaining components of *Into Science*.

## 3 DO I NEED TO STUDY ALL OF *INTO SCIENCE*?

In writing *Into Science* our concern has been that it is genuinely accessible for everyone interested in science. So the texts start at a basic level; we assume only that you can do basic arithmetic, that is, adding, subtracting, multiplying and dividing whole numbers. However, there is something to learn in *Into Science* whatever your background. **We recommend that you begin Module 1 as soon as you receive it so you can learn about the Course and get an idea about how long you personally need to set aside to study the Modules.** The amount of time will depend upon your previous educational experience and how long it is since you did any study. If you opted out of science at school before 16+ level (i.e. GCSE, CSE or GCE level) then you may find that you need to study the whole course quite carefully and should plan to do so.

On the other hand, even if you are fortunate enough to have three A-levels in science subjects, you will find plenty that is worthwhile in *Into Science*. For example, an introduction to a new branch of science (Earth Sciences, perhaps), or a chance to improve a skill such as writing scientific accounts.

If you got a good grade in maths at 16+ level then your mathematical skills are probably good and you will find some of the Modules relatively easy. Nevertheless, students with some background in maths have found that they greatly benefited from studying *Into Science* because it helped them to revise and also to see how mathematical skills are used in a scientific, rather than a mathematical, context.

One way of quickly discovering what is included in *Into Science* is to turn to the last Section—called the Overview—of each Module which summarizes the concepts and skills covered. (Note that each binding contains two Modules.) If the concepts look perfectly familiar to you and you feel comfortable with the list of skills, then you could test yourself by trying some of the questions in that particular Module or in the relevant Section of the Workbook to see if you get all the answers correct. Former students have rarely found themselves in this situation! Even if they have the skills introduced in the Module, they may be unfamiliar with some of the scientific concepts.

What *is* important is your own progress and you should measure that against *your* starting point and *not* that of other students. So allow yourself sufficient time to study *Into Science* and the best way of doing that is to start on Module 1 as soon as possible.

## 4 ASSIGNMENTS AND WHEN TO TACKLE THEM

Whether you feel confident at doing science or not, you may feel nervous about assignments. We have included some assignments, listed in Table 1, for you to practise before beginning the *Science Foundation Course*. They do not count towards S102 assessment in any way.

There are two kinds of assignments in *Into Science* and in S102. There are those that are marked by a computer (called CMAs, **c**omputer **m**arked **a**ssignments) and those that are marked by a tutor (called TMAs, **t**utor **m**arked **a**ssignments). CMAs contain short questions with about six

possible answers from which you have to choose the correct option. TMAs consist of a number of questions each of which requires a written answer in your own words. Details of how to submit the assignments are included with each assignment. There are a total of four assignments in *Into Science,* two CMAs and two TMAs:

The first CMA (S102 51) covers Modules 1 to 6 inclusive.

The second CMA (S102 52) covers Modules 7 to 10 inclusive.

The first TMA (TMA IS 01) covers Modules 1 to 7.

The second TMA (TMA IS 02) covers Modules 10 to 12.

If multiple choice questions are completely new to you we recommend that you tackle the CMA questions relating to a particular Module immediately after completing your study of that Module. In this way you will find that you can focus on the questions more easily and complete them more quickly. On the other hand, if you decide to wait and tackle all the questions on the CMA at one go (these may cover as many as six Modules), you will find this is a good test of how well you have learnt and understood the Modules. With practice you can choose the way that suits you best. The same is true for tackling TMA questions.

Most importantly, don't miss this opportunity to do the assignments and so get some practice for S102. You have until the end of February to complete and submit the CMAs although we *strongly* recommend that you complete them as you study *Into Science*. Your answers will be analysed by a computer, which will produce detailed feedback on each assignment; you will receive a separate letter for each assignment. Information about your performance on these practice CMAs is confidential; only you will learn about your results.

In about November your Regional Centre will give you the name, address and telephone number of your tutor-counsellor. He or she will provide help and support by letter or telephone or at meetings at your local Study Centre, where you can also meet other students studying *Into Science* and S102. Details of introductory study centre meetings are provided on a regional basis. You should submit your practice TMA (IS 01) to your tutor-counsellor by the date given by him or her. In addition, you may find it helpful to discuss your CMA results with your tutor-counsellor.

## 5 ITEMS YOU NEED TO PROVIDE

Each Module begins with a Study Guide which outlines the scope of that Module. It also tells you about any items that you need to study the Module. Essential items that you may need to buy are:

a calculator (see Module 1 for details)

a protractor and a pair of compasses (Module 9)

There are a number of activities and experiments spread throughout *Into Science* most of which use items commonly found in the home. Exceptional items which you may need to buy in advance of studying Module 7 are:

dried yeast (see Module 7 for details)

a thermometer that can measure to 100 °C or more (such as one used for jam-making) would also be useful.

## 6 THE TV PROGRAMMES

There are three television programmes transmitted in the pre-Christmas period and repeated in January. Details of the broadcast schedule are

included separately in this mailing. Notes to accompany the programmes are provided in this Section.

### 6.1 TV1 VOYAGES OF DISCOVERY

*Read this before watching the programme*

This programme which is 30 minutes long, is not linked to any particular Module of the course. It introduces you to the study of science by showing the wide range of disciplines and subjects that science encompasses. Just sit back and enjoy the programme; do not worry about the technical terms that are used.

The remaining two programmes are designed to help your understanding of some of the maths in *Into Science*. We hope the visual images you retain will help you in your study.

### 6.2 TV2 ALGEBRA

*Read this before watching the programme*

This programme, which is 15 minutes long, is linked to Module 8. It shows you how to rearrange equations that involve symbols as well as numbers. Try to study Module 8 *before* you watch the programme but this will depend upon when you begin to study *Into Science*. To help you follow the programme you should note that it is in two parts: (1) a number game, and (2) measuring the length of a tunnel.

(1) The rules for the number game Mike and Allan play at the beginning of the programme are: think of a number; double it; add 10; divide by 2; take away 3.

(2) Don't worry about the numbers in this part of the programme. The important thing to learn is the use of an algebraic equation like $d = st$ and that when using such an equation you need to know two of the factors to find out the third.

The aim of the second part of the programme is to work out the length of a tunnel on a train journey. To measure this Mike and Allan use the equation $d = st$ ($d$ is the length of the tunnel, $s$ is the train's speed and $t$ is the time taken to travel through the tunnel). They do it in two stages. First they measure $t$ and use this measurement (61 s) to practise the equation using a guessed value of 60 mph (miles per hour) for the speed.

In the second stage, they time the train over one mile and so calculate its speed, using the equation a second time. Finally, using the accurate measure of speed (72 mph) and the accurate time (61 s) for the tunnel journey, they use the equation for the third time to calculate the exact tunnel length.

### 6.3 TV3 GRAPHS

*Read this before watching the programme*

The programme is associated with Modules 7 and 10 and deals with plotting and interpreting graphs. Try to study Module 10 before watching the programme. The topics covered in TV3 are:

(i) choosing scales and axes

(ii) straight-line graphs and their related equations

(iii) interpretation of graphical data

(iv) an example of reworking of non-linear data to produce a straight-line graph.

Topic (iv) is not covered in *Into Science* but is introduced in the *Science Foundation Course*, so do not worry if you do not understand the last minute of the programme. To help you follow the programme read the following.

Mike discusses choosing a sensible scale for his graph of distance against time. The scale he initially chooses for the $y$ axis does not fit on the graph paper!

Allan shows how a graph can be used to convert °C (Celsius) to °F (Fahrenheit) without doing a lot of individual calculations. It is possible to read values *in between* points on both curved and straight line graphs; this is called **interpolation**. Although it is difficult to extend a curved graph (see Module 12) Allan shows how a straight line graph can easily be extended to **extrapolate** (see Module 12) values beyond either end of the given data.

In the Section on straight-line graphs, Allan describes how they can all be represented by an equation of the form:

$$y = mx + c$$

where $m$ is the gradient and $c$ is the intercept on the vertical axis. If you are still hazy about these ideas you will find more examples in Module 10.

Not all relationships are linear, but it is often helpful if we can work the data into a form that can be plotted as a straight-line graph. An explanation of how this is done is given in S102. Mike demonstrates that when this is done, extrapolation, for example, can be much more accurate. Mike ends the programme by saying that the next programme will be on angles. Please note there is no further TV programme associated with *Into Science*!

## 7 PRACTICE ASSIGNMENTS

This Section contains two computer marked assignments and one tutor marked assignment, along with full instructions on how to complete them and where to send them. The assignments have been designed to provide you with feedback on your progress through *Into Science* and to refresh your memory of some of the key points.

In the case of computer marked assignments your answers will be marked by a computer, which will produce detailed feedback on each assignment. The questions are primarily of two types:

1 Questions that test your understanding of the scientific concepts covered in *Into Science*. These concepts are listed in the Overview of each Module.

2 Questions that test the skills, particularly mathematical skills, introduced in *Into Science*. These skills are listed in the Overview of each Module. There are rather more of these questions than of type 1.

The assignments are not primarily to test your memory. You can refer to the relevant part of the texts as you answer the questions. You should work out the problems as you would a **s**elf **a**ssessment **q**uestion (SAQ) and then check against the possible answers given. *There are no trick questions*.

Don't be put off by the idea of a computer analysing your work and giving you feedback, or because the assignment looks complicated. Computer analysis is quite straightforward, as explained in the next Section.

### 7.1 THE ASSIGNMENT FORM

In order for the computer to be able to read your assignment, your answers need to be entered on special assignment forms. Two of these are included in the *Into Science* mailing. You will find it helpful to have one of the forms beside you as you read through this Section.

The form is divided into two parts:

Part 1 has spaces for you to write in your name, address, personal identifier, the course and assignment number and the date that you send in the form. It also has two computer-read blocks, one of which is for your personal identifier and the other for the number of the assignment.

Part 2 is divided into 60 rows, each numbered, and containing 10 'cells'. The cells contain the letters A to H, a question mark symbol, and the letter U. You indicate your answer to the assignment questions by pencilling across one of these cells.

Figures 1 to 4 show you how to fill in the form. To make the marks on the form:

- Use an HB pencil and press firmly.
- Press across the cells with a firm horizontal line as shown.
- Do not go outside the cells.

1 Write your surname, initials and address, personal identifier, course and assignment number (see 4 below) and date sent, in the spaces provided at the top left hand corner of the form (Figure 1). Please write clearly in block capitals.

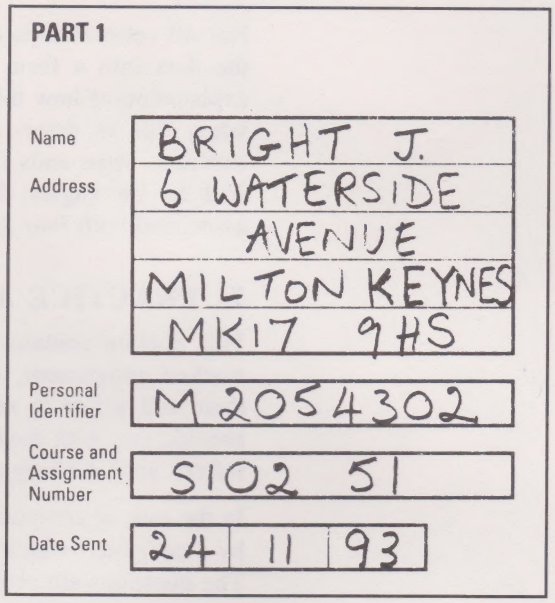


FIGURE 1 How to complete your personal details.

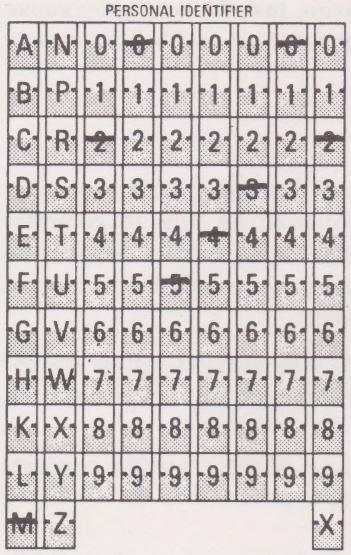


FIGURE 2 Personal identifier.

2 Fill in your personal identifier again by marking the appropriate upper cells in Part 1 of the form. For example, if your personnel identifier is M2054302, you would fill in the (personal identifier) block as shown in Figure 2.

3 For course and assignment number you should use the following codes:

For the first CMA, use S102 51

For the second CMA, use S102 52

You should have written the assignment number in the appropriate space underneath your personal identifier (Figure 1). You should also pencil across the corresponding cells in the course and assignment number block, as shown in Figure 3.

If you are sending answers to the first CMA, you should pencil out cells 51 in the columns on the far right of Figure 3; if to the second CMA, you should pencil out the appropriate cells 52. We have shown the marking for the first CMA.

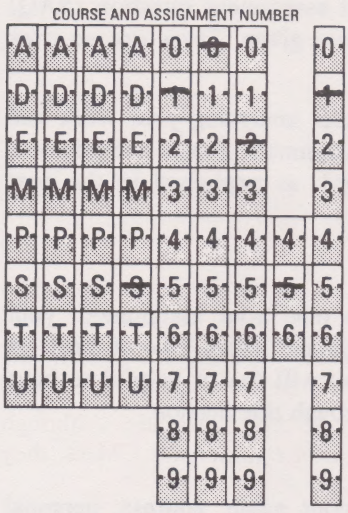


FIGURE 3 Course and assignment number.

4 When you have answered all the questions in an assignment, transfer your answer to each question in the appropriate cell in Part 2 of the form. Since the first CMA has 10 questions, each with only one correct response, you should mark one cell in each of rows 1 to 10 of the answer block, as shown in the example in Figure 4. (If there are any feedback questions use rows 11 onwards.)

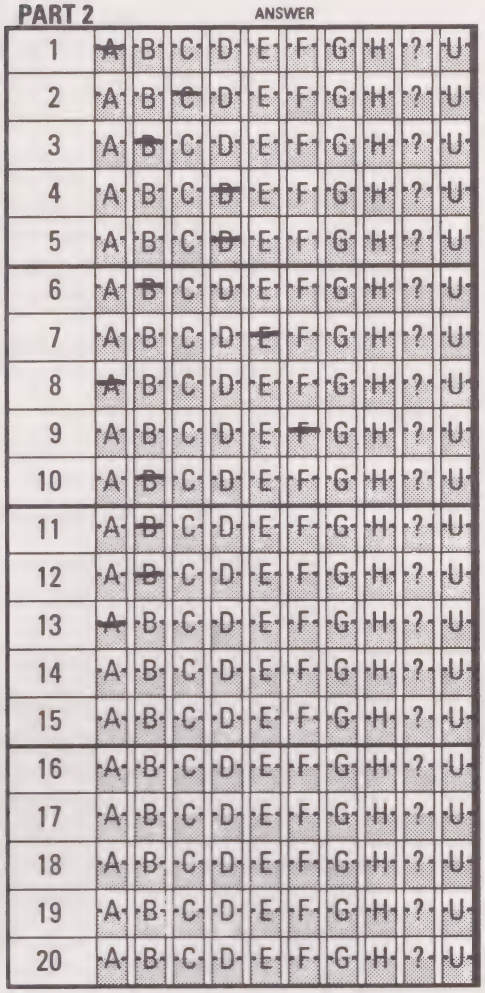


FIGURE 4 Part 2 of the form.

5 We advise you to attempt every question in each assignment. But if you do not wish to answer a question, and are not prepared to guess, pencil across the 'don't know' cell(?). If you feel that any question is unsound, you should pencil across the cell containing the letter U in addition to your answer cell.

### 7.2 WHAT TO DO AFTER COMPLETING THE COMPUTER-MARKED ANSWER FORM

6 Fold the computer form along the line indicated and post it in the pre-addressed envelope provided, but you will need to stick on a stamp. Please mark your envelope in the upper left-hand corner clearly in large letters: **S102 PRP**.

All details of your answers will be treated as confidential to yourself and the University.

7 The computer commentary should reach you in 3-4 weeks. In the meantime, you should continue work on the *Into Science* Modules.

8 You can send in the forms as soon as they are ready. Although there are no fixed dates for submission of *Into Science* CMAs, they will not be processed after 28 February.

9 The computer print-out will, for each question you get wrong, give the correct answer, indicate the source of your error, and suggest which Sections you should re-read. (The problems in the Workbook could be useful at this stage.)

10 If you are still mystified after re-reading the Sections and working through a few Supplementary Exercises, you should get in touch with your tutor-counsellor.

11 There is no need to *worry* if you don't get all the answers in the CMAs right. You will undoubtedly have learnt something from your study of the Modules. If there are Sections where you consistently get exercises and test questions wrong, then at least we have succeeded in diagnosing your problem. Once you know exactly where your difficulties lie, you will find it much easier to get help (from your tutor-counsellor, for example) to overcome them.

## 7.3 EXAMPLES OF ASSIGNMENT QUESTIONS

If you have never answered multiple choice questions before then here are a few to try (with the answers provided), before you have a go for yourself with CMA 51. We have also provided a few hints on what to look out for in the language of CMAs.

**Q1** Which one of the following statements about mass is CORRECT? Select *one* key item from the key for Q1.

KEY for Q1

A A gram of iron has a greater mass than a gram of feathers

B Weight is the same as mass

C A person's mass is different on Earth from on the Moon

D Mass is *always* measured in the unit, grams

E The mass of a bag of sugar can be measured on a pair of kitchen scales

**Answer and comments for Q1**

The correct response is E. All other items are wrong. Common sense tells you that some items are wrong. For example, item A, a gram of anything whether it is iron, chocolate, flour or feathers has the *same* mass although the volume of these items is different. Key item B you know is wrong from the Box in Module 1. Key item C is true for weight but not for mass—so be sure of your definitions! Item D is wrong because mass can be measured in kilograms, milligrams or other units—the word *always* is the give-away word. Other give-away words are given in the following variations of key item D of Q1.

Mass is *only* measured in g (wrong)

Mass is *never* measured in g (wrong)

Mass is *sometimes* measured in g (correct)

Notice how the give-away word makes the statement CORRECT or WRONG.

Now try the next question:

**Q2** Which one of the following equations involving negative numbers is WRONG? Select *one* key item from the key for Q2.

KEY for Q2

A $(-6) \times (+6) = -36$

B $(+6) + (-6) = 0$

C $(+6) \div (-6) = -1$

D $(+6) - (-6) = +12$

E $(-6) \times (-6) = +36$

F $(-6) \div (-6) = -1$

**Answer and comments for Q2**

The correct response is F. In other words the WRONG rule is given in F. All other key items are correct.

Did you find you were looking for the CORRECT key item in Q2 as you were in Q1? BE WARNED it is very easy to forget to switch to looking for WRONG key items after looking for CORRECT key items in the previous question. Try to develop good habits for dealing with this problem, such as checking your answers before transferring them to the CMA form.

Course and assignment number:

# Computer Marked Assignment

**S102 51**

**This assignment must reach Walton Hall before the end of February. CMAs received after the cut-off date will not be marked.**

**Covering: Modules 1–6**

Make sure you know how to use the CMA form: detailed instructions are given in **Section 7 of THIS booklet.**
You are advised to attempt every question in this assignment.
If you do not wish to answer a question, pencil across the 'don't know' cell ('?').
If you think that a question is unsound in any way, pencil across the 'unsound' cell ('U') *in addition to* pencilling across either an answer cell or the 'don't know' cell.
*Note For each question, you* **must** *pencil across* **either** *the required number of answer cells* **or** *the 'don't know' cell.*

---

**CMA 51**

This CMA covers Modules 1–6.

**PART A**

*The questions in this part relate to Modules 1 and 2 and carry 20% of the marks for this assignment.*

**Q1** Rice contains 5% fat. Which *one* of the following key items for Q1 is TRUE?

KEY for Q1

A In 5 kg of rice there is 1 kg of fat
B In 10 kg of rice there is 0.2 kg of fat
C In 50 kg of rice there is 5 kg of fat
D In 8 kg of rice there is 0.4 kg of fat
E In 105 kg of rice there is 5 kg of fat
F In 0.5 kg of rice there is 250 g of fat

Pencil across *one* cell in row 1.

**Q2** When driven 'normally', the fuel consumption of a car is exactly 7 litres per 100 km. On a particular journey of 340 km the car is driven 'hard' and the consumption changes to exactly 9 litres per 100 km. If fuel costs 50 p per litre, what is the extra cost of fuel for the journey? Select *one* CORRECT item from the key for Q2.

KEY for Q2

A £1.70
B £2.10
C £3.40
D £4.20
E £4.80
F £6.80

Pencil across *one* cell in row 2.

---

**PART B**

*The questions in this part relate to Module 3 and carry 40% of the marks for this assignment.*

**Q3** The KEY for Q3 lists various rocks paired with a process of rock formation. Select from the key the *one* pairing which is WRONG.

KEY for Q3

A clay; sedimentary
B marble; metamorphic
C basalt; igneous
D slate; metamorphic
E limestone; sedimentary
F granite; metamorphic

Pencil across *one* cell in row 3.

**Q4** A rectangular slab of granite, 0.700 m by 0.450 m, and 3.50 cm thick, has a mass of 30.3 kg. What is the density of granite in g per $cm^3$? (Hint: watch out for units and significant figures.) Select *one* CORRECT item from the KEY for Q4.

KEY for Q4

A 0.002 75 g per $cm^3$
B 2.748 299 g per $cm^3$
C 2.75 g per $cm^3$
D 27.5 g per $cm^3$
E 2 750 g per $cm^3$
F 27 500 g per $cm^3$

Pencil across *one* cell in row 4.

**Q5** You need to estimate the scrap value of roofing lead from a flat roof that measures exactly 24 m × 3 m. Lead is worth £5 500 per cubic metre. The thickness of the lead can be measured with a millimetre rule to the nearest millimetre and, with the rule, you estimate its thickness to be exactly 2 mm. After selling the lead you obtain a more accurate measuring device, a micrometer screw gauge, and discover the lead is 2.25 mm thick. How much money have you lost? Select *one* item from the key which gives the money you lost to the nearest whole pound.

KEY for Q5

| | |
|---|---|
| A £792 | D £100 |
| B £99 | E £101 |
| C £891 | F £162 |

Pencil across *one* cell in row 5.

**Q6** Figure 1 shows a hill faced by two ramblers planning a hike in the Peak District. What is its length? Select *one* CORRECT item from the key for Q6.

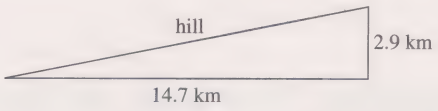


FIGURE 1 A hill in the Peak District, for use with Q6.

KEY for Q6

| | |
|---|---|
| A 15 km | D 18 km |
| B 14 km | E 4 km |
| C 17 km | F 12 km |

Pencil across *one* cell in row 6.

---

## PART C

*The questions in this part relate to Module 4 and carry 20% of the marks for this assignment.*

**Q7** A rectangular box is 1.5 metres long, 1.0 metre wide and 50 cm high. What is its volume? Select *one* CORRECT item from the key for Q7.

KEY for Q7

| | |
|---|---|
| A $7.5 \times 10^{-1}\ m^3$ | D $7.5 \times 10^{3}\ cm^3$ |
| B $7.5\ m^3$ | E $75\ m^3$ |
| C $7.5 \times 10^{4}\ m^3$ | F $750\ m^3$ |

Pencil across *one* cell in row 7.

**Q8** The mass of the Moon is $7.35 \times 10^{22}$ kg and its volume is $2.199 \times 10^{19}\ m^3$. What is the density of the Moon? Select *one* CORRECT item from the key for Q8.

KEY for Q8

| | |
|---|---|
| A $3.34 \times 10^{3}\ kg\ m^3$ | D $3.34 \times 10^{3}\ kg\ m^{-3}$ |
| B $0.299 \times 10^{41}\ kg\ m^3$ | E $3.00 \times 10^{-3}\ kg\ m^{-3}$ |
| C $3.00 \times 10^{42}\ kg\ m^3$ | F $3.00 \times 10^{-3}\ kg\ m^3$ |

Pencil across *one* cell in row 8.

---

## PART D

*The questions in this part relate to Modules 5/6 and carry 20% of the marks for this assignment.*

**Q9** What is the mass of a sulphate ion ($SO_4^{2-}$) compared with the mass of one hydrogen atom? (Relative mass of H = 1, S = 32 and O = 16). Select *one* item from the key for Q9.

KEY for Q9

| | |
|---|---|
| A 32 | D 76 |
| B 48 | E 96 |
| C 64 | F 116 |

Pencil across *one* cell in row 9.

**Q10** Which one of the following chemical equations is *not* balanced? (All reactants and products are given.) Select *one* item from the key for Q10.

KEY for Q10

A $CaO + H_2SO_4 = CaSO_4 + H_2O$

B $2Zn + O_2 = 2ZnO$

C $FeS + 2HCl = FeCl_2 + H_2S$

D $CH_4 + 4Cl_2 = CCl_4 + 2HCl$

E $Cl_2 + 2NaI = 2NaCl + I_2$

F $CaO + 2HCl = CaCl_2 + H_2O$

Pencil across *one* cell in row 10.

---

## PART E FEEDBACK QUESTIONS

If you complete the following questions about Modules 2 to 6, the information will help us to make improvements to *Into Science*. Only the computer will know your own particular answers. The Course Team will be given only a compilation of everybody's answers, so please be honest.

**Q11** How *interesting* and how *difficult* did you find Module 2? Choose *one* option from items A to D and *one* option from items E to H in the key for Q11 to Q14.

KEY for Q11 to Q14

| | | | |
|---|---|---|---|
| A | Very interesting | E | Very difficult |
| B | Fairly interesting | F | Fairly difficult |
| C | Not very interesting | G | Not very difficult |
| D | Not at all interesting | H | Not at all difficult |

Pencil across *two* cells in row 11.

**Q12** How *interesting* and how *difficult* did you find Module 3? Choose *one* option from items A to D and *one* option from items E to H in the key for Q11 to Q14.

Pencil across *two* cells in row 12.

**Q13** How *interesting* and how *difficult* did you find Module 4? Choose *one* option from items A to D and *one* option from items E to H in the key for Q11 to Q14.

Pencil across *two* cells in row 13.

**Q14** How *interesting* and how *difficult* did you find Modules 5/6? Choose *one* option from items A to D and *one* option from items E to H in the key for Q11 to Q14.

Pencil across *two* cells in row 14.

The Open University

Science Supplementary Material
**Into Science**

Course and assignment number:

# Tutor Marked Assignment

# TMA IS 01

Make sure you know how to complete and send in your TMA:
detailed instructions are given in **Section 4 of THIS booklet.**
Please return your completed assignment to your **tutor-counsellor**.

Covering: **Modules 1 to 7**

**Completing your TMA**

Use A4 size paper for your written assignment, and put your name, personal identifier and assignment number at the top of every sheet.

**Sending in your TMA**

The completed TMA should be returned to your tutor-counsellor for marking. Before mailing make sure that you have put your name and address on the back of the envelope.

---

**Continuing students please note:**
You should not submit this practice TMA to your tutor-counsellor since you already have experience of completing TMAs. We do advise you, however, to complete the CMAs in order for you to get feedback on your progress with *Into Science*.

This assignment consists of three questions that relate to Modules 1 to 7 of *Into Science*. At the beginning of each question, there is a statement telling you to which Module the question relates. Each question is straightforward and aims to give you practice in writing science. If you have already studied science you may find the questions quite easy.

TMA IS 01, unlike the TMAs of S102, is a formative assignment, that is, it helps you to learn from the feedback you get, but does not count towards S102 assessment in any way. This assignment should take you about one hour to complete.

As you complete this assignment you will be developing the following skills:

- using appropriate methods to help interpret results
- using maps, diagrams and graphs to obtain information
- writing an account on a given topic
- using graphs to explain data.

## Question 1

*This question relates to Module 2.*

Four S102 students (A–D) carried out an experiment to measure the time it took an empty can to roll down a gentle incline. They rolled the can five times. Each student measured the time using their own stop watch. Their results are given in Table 1.

TABLE 1

| A time/s | B time/s | C time/s | D time/s |
|---|---|---|---|
| 6.0 | 7.0 | 7.1 | 7.2 |
| 6.1 | 7.1 | 7.2 | 7.0 |
| 5.9 | 7.4 | 6.9 | 6.9 |
| 6.3 | 6.8 | 7.0 | 7.1 |
| 6.0 | 6.8 | 6.8 | 7.1 |

At a tutorial, the tutor read their accounts of the experiment and the average times that each student had noted were as follows:

A 6.1 s; B 7.0 s; C 7.00; D 7.03 s

Comment on each of the answers given by A–D, writing about 10–20 words on each. Your answer should refer as appropriate to the following: accuracy of calculation, significant figures, rounding up and rounding down, and units.

## Question 2

*This question relates to Modules 3 and 4.*

Find York on the map, Figure 6 in Module 3, Looking at Buildings. Using the map and the key to the Figure, answer the following questions.

(a) (i) What information is given about the rocks on which York is built?

(ii) What is the age of these rocks, both in millions of years and in scientific notation?

(b) (i) Are the rocks igneous, sedimentary or metamorphic?

(ii) In your own words, describe how the rocks given in your answer to (b) (i) were formed. (You will need to refer to several pages of Module 3. Try to answer part (b) in no more than 120 words.)

(c) Suggest one reason why it would have been more difficult to answer part (a) for Glasgow than for York. (Try to answer part (c) in no more than 60 words.)

**Question 3**

*This question relates to Modules 5/6 and 7.*

It is possible to dissolve more and more sodium chloride in water at (say) 0 °C until a point is reached when no more will dissolve. At this point the solution is said to be *saturated*. The solubility (at 0 °C in saturated solution) is quantitatively expressed as:

grams sodium chloride per litre of saturated solution (units are $g\,l^{-1}$).

This is the *concentration* of sodium chloride in the saturated solution.

The solubility of both sodium chloride and potassium nitrate (expressed as grams of dissolved substance per litre of saturated solution) varies with temperature in the manner shown in Figure 1.

(a) What is the concentration of a saturated solution of potassium nitrate at 20 °C?

(b) At what temperature is the solubility (in saturated solution) of potassium nitrate and sodium chloride the same?

(c) Comment on the shape of the two graphs and explain what they tell you about the relative solubilities of the two substances. (Try to answer part (c) in no more than 100 words.)

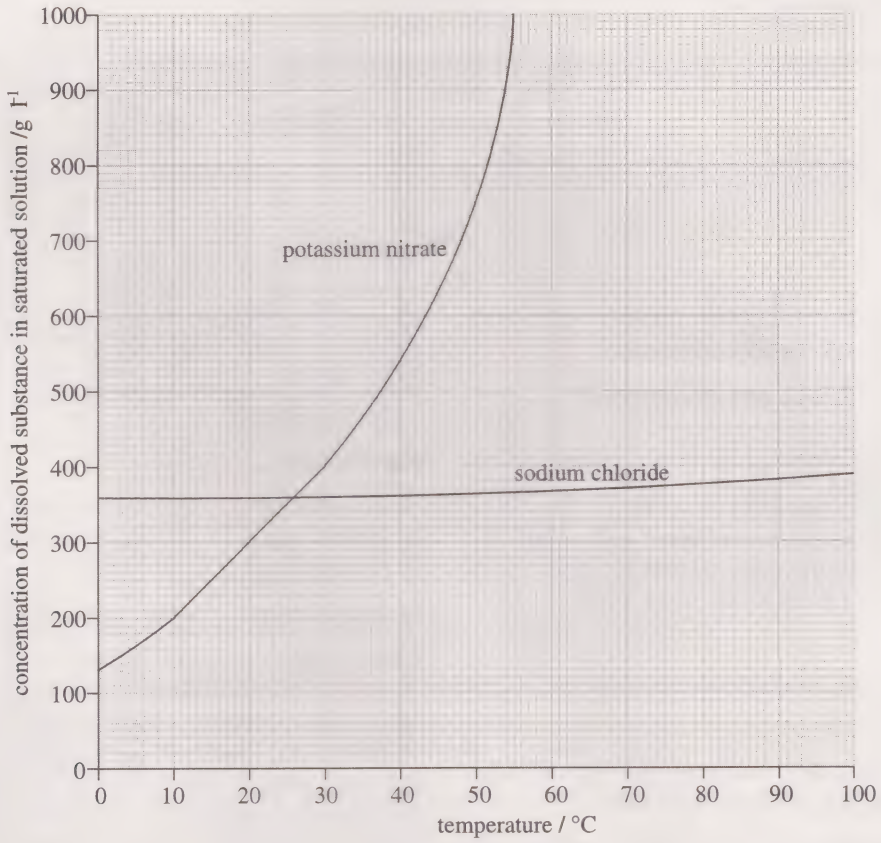


FIGURE 1 Variation in the solubility of potassium nitrate and sodium chloride with temperature.

The Open University
Science Supplementary Material
**Into Science**

Course and assignment number:

# Computer Marked Assignment

**S102 52**

**This assignment must reach Walton Hall before the end of February. CMAs received after the cut-off date will not be marked.**

Covering: **Modules 7–10**

Make sure you know how to use the CMA form: detailed instructions are given in **Section 7 of THIS booklet.**
You are advised to attempt every question in this assignment.
If you do not wish to answer a question, pencil across the 'don't know' cell ('?').
If you think that a question is unsound in any way, pencil across the 'unsound' cell ('U') *in addition to* pencilling across either an answer cell or the 'don't know' cell.
*Note For each question, you* **must** *pencil across* **either** *the required number of answer cells* **or** *the 'don't know' cell.*

---

**CMA 52**

This CMA covers Modules 7–10. However, you also need to use some of the maths skills from earlier Modules.

**PART A**

*The questions in this part relate to Module 7 and carry 16% of the marks for this assignment.*

**Q1** Exactly 5g of dried yeast is stirred into a large amount of a warm solution of sugar and other food required for the growth of yeast. The mixture is kept warm for several days and then the yeast is filtered off, washed and dried. The mass of yeast has increased to 320g. Assuming the mass doubles at each cycle of cell division, how many cycles of cell division have occurred? Select *one* CORRECT item from the key for Q1.

KEY for Q1

| | |
|---|---|
| A 4 | D 8 |
| B 5 | E 32 |
| C 6 | F 64 |

Pencil across *one* cell in row 1.

**Q2** The graph (Figure 1, opposite) shows temperature in degrees Celsius recorded over a 24 hour period. For how long was the temperature below 10 °C over this period? Select *one* CORRECT item from the key for Q2.

KEY for Q2

| | |
|---|---|
| A 5 h 30 mins | E 8 h 48 mins |
| B 5 h 48 mins | F 9 h 36 mins |
| C 8 h 30 mins | G 10 h 12 mins |
| D 8 h 40 mins | H 11 h 12 mins |

Pencil across *one* cell in row 2.

---

**PART B**

*The questions in this part relate to Module 8 and carry 36% of the marks for this assignment.*

**Q3** 100 g of chocolate cake has an energy content of 546 kJ. What amount would someone have to eat to provide the energy of 1 500 J needed to walk upstairs? Assume that all of the energy in the cake can be made available to the body and calculate the answer to 2 significant figures. Select *one* CORRECT item from the key for Q3.

KEY for Q3

| | |
|---|---|
| A 0.15 g | D 2.7 g |
| B 0.27 g | E 27 g |
| C 1.5 g | F 3.6 g |

Pencil across *one* cell in row 3.

**Q4** The rotational kinetic energy of the Earth is $10^{29}$ J and the energy received by the Earth from the Sun each year is $5 \times 10^{24}$ J. By how many times does the rotational kinetic energy of the Earth exceed the energy received by the Earth from the Sun each year. Select *one* CORRECT item from the key for Q4.

KEY for Q4

| | |
|---|---|
| A $2 \times 10^3$ | D $5 \times 10^4$ |
| B $5 \times 10^3$ | E $2 \times 10^5$ ? |
| C $2 \times 10^4$ | F $5 \times 10^5$ |

Pencil across *one* cell in row 4

**Q5** Make $x$ the subject of the equation $y = 10x + 2$ and then find the value of $x$ when $y = 14$. Select from the key for Q5 the *one* CORRECT item

KEY for Q5

| | |
|---|---|
| A 142 | D 2 |
| B 0.83 | E 10 |
| C 1.2 | F 14 |

Pencil across *one* cell in row 5.

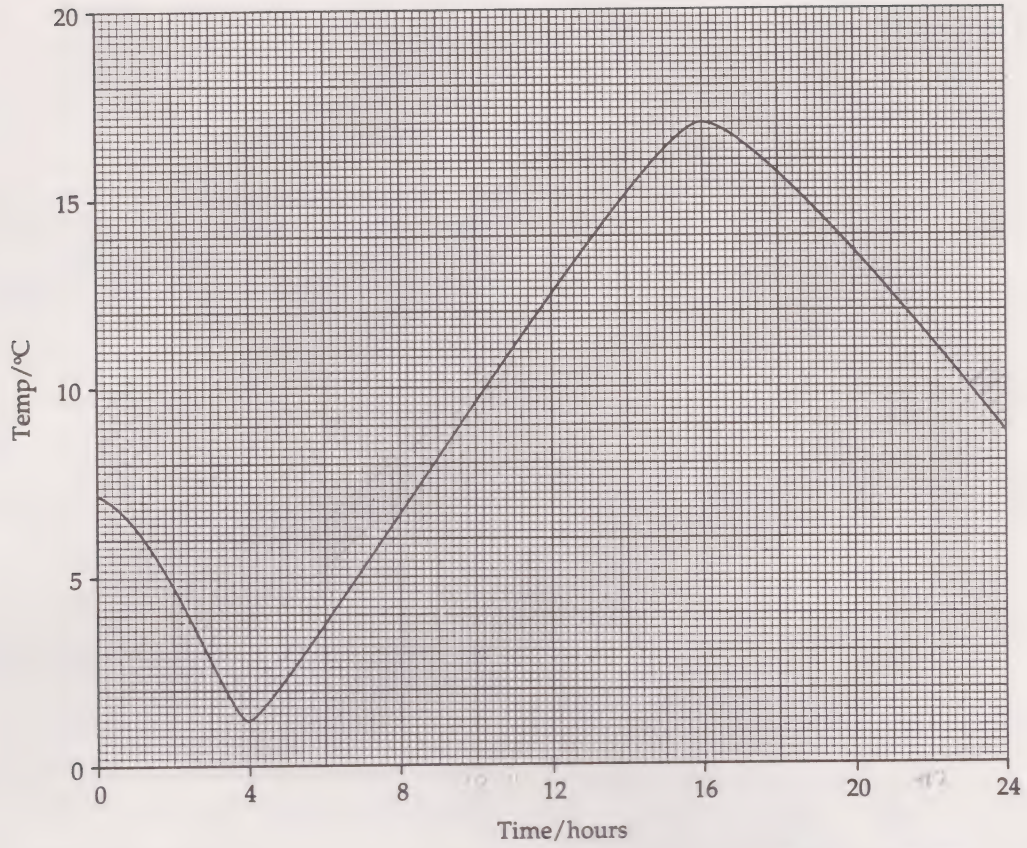


FIGURE 1 Graph showing temperature recorded in degrees Celsius over a 24 hour period, for use with Q2.

---

**Q6** Rearrange the equation $V = \pi r^2 h$, to make $h$ the subject. Select *one* CORRECT item from the key for Q6.

KEY for Q6

A $h = \sqrt{\frac{V}{\pi}}$

B $h = V - \pi r^2$

C $h = \frac{V}{\pi r^2}$

D $h = V\pi r^2$

E $h = \frac{\pi r^2}{V}$

F $h = V - \pi\sqrt{r^2}$

Pencil across *one* cell in row 6.

---

## PART C

*The questions in this part relate to Module 9 and carry 24% of the marks for this assignment.*

**Q7** The Earth is very nearly a sphere of radius 6 370 km; 71% of the surface of the Earth is covered by oceans. The average depth of the oceans is 3.7 km. What is the volume of water in the oceans of the Earth? Select from the key for Q7 the key item that is closest to your answer.

KEY for Q7

A $2.1 \times 10^5\,\text{km}^3$

B $1.3 \times 10^9\,\text{km}^3$

C $1.9 \times 10^9\,\text{km}^3$

D $1.3 \times 10^{10}\,\text{km}^3$

E $1.7 \times 10^{10}\,\text{km}^3$

F $2.1 \times 10^{10}\,\text{km}^3$

Pencil across *one* cell in row 7.

**Q8** Two points A and B lie on the same line of longitude on a spherical planet and are 295 km apart as shown in Figure 2. The latitudes of A and B differ by exactly 5°. What is the radius of the planet. (Hint: what is the circumference?) Select *one* CORRECT item from the key for Q8.

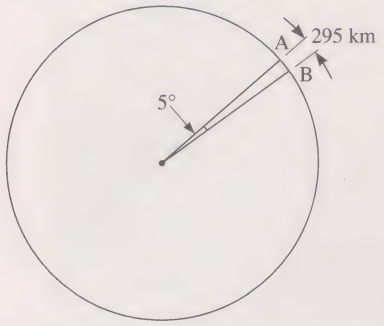


FIGURE 2 Two points A and B on a spherical planet, for use with Q8.

KEY for Q8

| | |
|---|---|
| A 1 690 km | D 3 380 km |
| B 2 950 km | E 6 370 km |
| C 3 385 km | F 6 760 km |

Pencil across *one* cell in row 8.

**Q9** A spherical balloon has a radius 9.0 cm. It is inflated further, increasing its radius by 10% to 9.9 cm. What is the increase in volume in $cm^3$ (to 2 significant figures)? Select *one* CORRECT item from the key for Q9.

KEY for Q9

| | |
|---|---|
| A 10 $cm^3$ | D 240 $cm^3$ |
| B 9.0 $cm^3$ | E 970 $cm^3$ |
| C 9.9 $cm^3$ | F 1 000 $cm^3$ |

Pencil across *one* cell in row 9.

---

## PART D

*The questions in this part relate to Module 10 and carry 24% of the marks of this assignment.*

**Q10** A tree which is 20 metres high has a shadow 15 metres long, as shown in Figure 3. What is the angle of the Sun (marked α in the figure)? Select *one* CORRECT item from the Key for Q10.

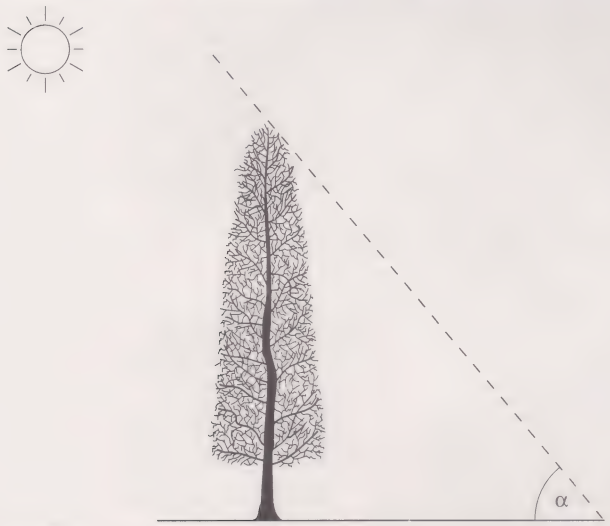


FIGURE 3 A tree and it shadow, for use with Q10.

KEY for Q10

| | |
|---|---|
| A 36.9° | D 53.1° |
| B 48.6° | E 89.8° |
| C 41.4° | F 88.4° |

Pencil across *one* cell in row 10.

**Q11** Table 1 shows the distance of a car from a garage at certain intervals of time.

TABLE 1 Distance of car from garage with time.

| time/minutes | 0 | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 |
|---|---|---|---|---|---|---|---|---|---|---|
| distance/miles | 0 | 10 | 20 | 20 | 20 | 40 | 60 | 40 | 20 | 0 |

The data in Table 1 are plotted on the graph in Figure 4, opposite. Select from the key for Q11 *two* CORRECT statements about the journey.

KEY for Q11

A The car travelled at 60 mph between B and C.

B Between A and B, the car travelled at the same speed as it did between C and D.

C The car travelled a total of 60 miles.

D The car eventually returned to its starting point.

E The car was out of the garage for a total of 60 minutes.

F The car broke the speed limit of 70 mph between D and E.

G The car was furthest from the garage at the end of the journey.

H The driver had time for a snooze at point D.

Pencil across *two* cells in row 11.

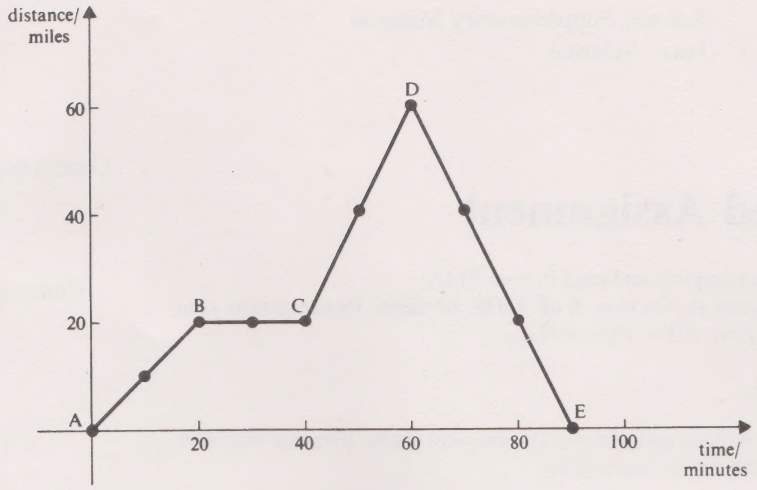


FIGURE 4 Distance car travelled from garage against time, for use with Q11.

**Q12** Figure 5 shows how much it costs per year to play golf at 'University Links'. Which *one* of the following statements in the key for Q12 about the graph is CORRECT?

KEY for Q12

A The gradient of the line tells us what the annual subscription is.

B To play 10 rounds a member would pay £36 including the annual subscription.

C The annual subscription is £18.

D The point (10, 52) is on the given line.

E The equation of the line is $y = 6.5x + 18$.

F The line goes through the point $(-1, 0)$

Pencil across *one* cell in row 12.

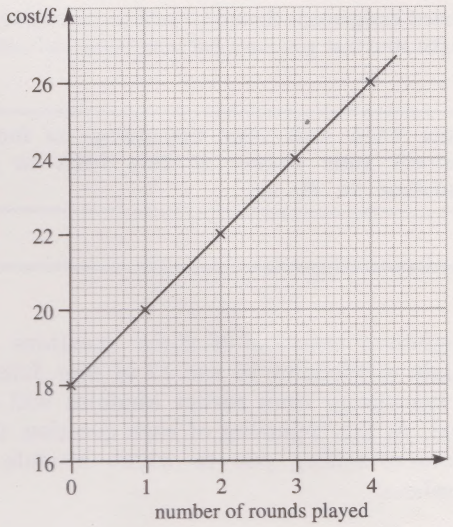


FIGURE 5 The cost per year of playing golf, for use with Q12.

## PART E FEEDBACK QUESTIONS

If you complete the following questions about Modules 7 to 10 and the Workbook, the information will help us to make improvements to *Into Science*. Only the computer will know your own particular answers. The Course Team will be given only a compilation of everybody's answers, so please be honest.

**Q13** How *interesting* and how *difficult* did you find Module 7? Choose *one* option from items A to D and *one* option from items E to H in the key for Q13 to Q17.

KEY for Q13 to Q17

| | |
|---|---|
| A Very interesting | E Very difficult |
| B Fairly interesting | F Fairly difficult |
| C Not very interesting | G Not very difficult |
| D Not at all interesting | H Not at all difficult |

Pencil across *two* cells in row 13.

**Q14** How *interesting* and how *difficult* did you find Module 8? Choose *one* option from items A to D and *one* option from items E to H in the key for Q13 to Q17.

Pencil across *two* cells in row 14.

**Q15** How *interesting* and how *difficult* did you find Module 9? Choose *one* option from items A to D and *one* option from items E to H in the key for Q13 to Q17.

Pencil across *two* cells in row 15.

**Q16** How *interesting* and how *difficult* did you find Module 10? Choose *one* option from items A to D and *one* option from items E to H in the key for Q13 to Q17.

Pencil across *two* cells in row 16.

**Q17** How *interesting* and how *difficult* did you find the Workbook? Choose *one* option from items A to D and *one* option from items E to H in the key for Q13 to Q17.

Pencil across *two* cells in row 17.

The Open University

Science Supplementary Material
**Into Science**

Course and assignment number:

# Tutor Marked Assignment

# TMA IS 02

Covering: **Modules 10 to 12**

Make sure you know how to complete and send in your TMA: detailed instructions are given in **Section 4 of THIS booklet**. Please return your completed assignment to your **tutor-counsellor**.

**Completing your TMA**

Use A4 size paper for your written assignment, and put your name, personal identifier and assignment number at the top of every sheet.

**Sending in your TMA**

The completed assignment should be sent to your tutor-counsellor for marking. Before mailing, make sure that you have put your name and address on the back of the envelope.

**Use of this TMA will vary depending on local arrangements. You should submit your answer to this TMA to your tutor-counsellor only if advised to do so.**

---

This assignment consists of three questions that relate mainly to Modules 10 and 12 of *Into Science*, although knowledge from earlier Modules will also be required. At the beginning of each question, there is a statement telling you to which Module the question relates.

TMA IS 02, unlike the TMAs of S102, is a formative assignment, that is, it helps you to learn from the feedback you get, but does not count towards S102 assessment in any way. The purpose of the marks in this assignment is to give you feedback on your performance. Since this is a short assignment, the marks add up to 50. All S102 assignments are longer than this one and the marks add up to 100. This assignment should take you about one and a half hours to complete.

As you complete this assignment you will be developing the following skills:

- applying knowledge to make predictions
- writing a short account on a given topic
- analysing and interpreting information from a graph and the Course texts.

## Question 1

*This question relates mainly to Module 10 and carries 20 of the 50 marks for this assignment.*

A glass ball was allowed to fall freely through silicone oil in a glass cylinder. The graph in Figure 1 shows the height of the ball above the base of the cylinder at certain times after its release. Give your answers to (a), (b), (c) and (d) in scientific notation (Module 4) and using scientific units (see Table on back cover of Module 2).

(a) From what height was the ball dropped? (*4 marks*)

(b) Reading from the graph, what was the height of the ball after 4 s? (Module 7 explains how to read from a graph.) (*4 marks*)

(c) What is the gradient of the graph? Show clearly how you worked this out. (Module 10 should be useful here.) (*5 marks*)

(d) What is the intercept on the $y$ axis of the graph? In this instance, what does the intercept tell us? (Again Module 10 should be useful.) (*4 marks*)

(e) Using your answers to (c) and (d), write down the equation for the graph shown in Figure 1. (Module 10, Section 4 should be useful here.) (*3 marks*)

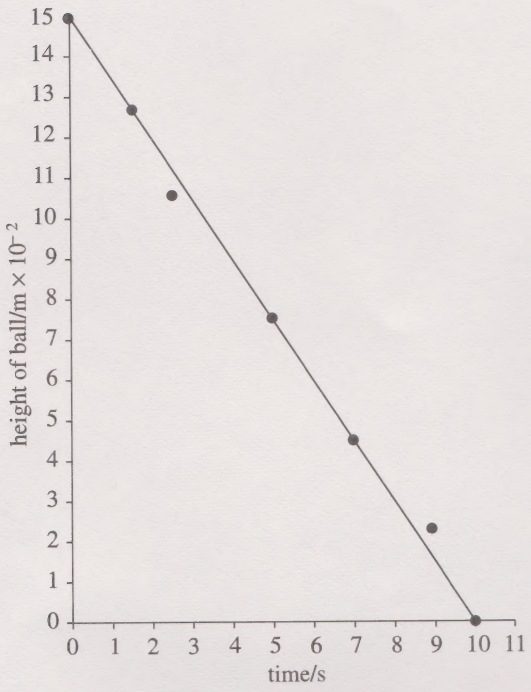


FIGURE 1 For use with Question 1.

**Questions 2 and 3**

Read Module 12 through fairly quickly (if you have not already done so), then read the following questions. Re-read the relevant part of Module 12 more carefully, taking note of information that will help you answer the questions. Finally, answer the questions in your own words as far as possible. Write in full sentences and try to keep to the word limit suggested. Module 11 might be helpful here.

**Question 2**

*This question relates mainly to Module 12 and carries 10 of the 50 marks for this assignment.*

Explain how scientists know that the amount of $CO_2$ in the atmosphere today is higher than it was 100 years ago. (Your answer should be no more than 50 words long.) *(10 marks)*

**Question 3**

*This question relates mainly to Module 12 and carries 20 of the 50 marks for this assignment.*

(a) Give the dates of two periods during the Earth's history when temperatures remained below the present average for Britain for at least 600 years. *(8 marks)*

(b) Explain whether it is possible that either of these cold periods came to an end as a consequence of increased $CO_2$ emissions from human activity. (Your answer should be no more than 100 words long.) *(12 marks)*

## INTO SCIENCE MODULES

1 GETTING STARTED
2 OBSERVING AND MEASURING
3 LOOKING AT BUILDINGS
4 THE SIZE OF THINGS
5/6 FOOD AND DRINK: A CHEMICAL STORY
7 LIVING MATERIAL
8 ENERGY
9 NAVIGATING AROUND
10 SURVEYING
11 GOOD WRITING IN SCIENCE
12 FOSSIL FUELS AND CLIMATE CHANGE

SUP 28904 6